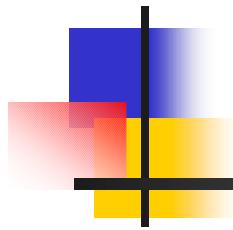
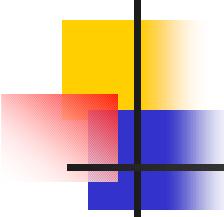


LQ search in eejj channel



Simona Rolli (TUFTS)

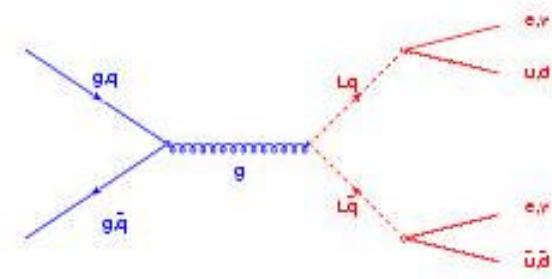


Introduction

- Some beyond the SM models assume additional symmetry between leptons and quarks
- LeptoQuarks – transition between leptons and quarks
 - Have both lepton and baryon numbers
 - λ - unknown coupling to leptons and quarks

LQ at the TeVatron

- Production
 - $qg \rightarrow LQ + L\bar{Q}$
 - $gg \rightarrow LQ + L\bar{Q}$
 - $q\bar{q} \rightarrow LQ + L\bar{Q}$
- Decay
 - $LQ \rightarrow l^+l^-qq, l^\pm n\bar{q}q, nn\bar{q}q$
- Experimental signature:
 - High pt isolated leptons (and/or MET) + jets

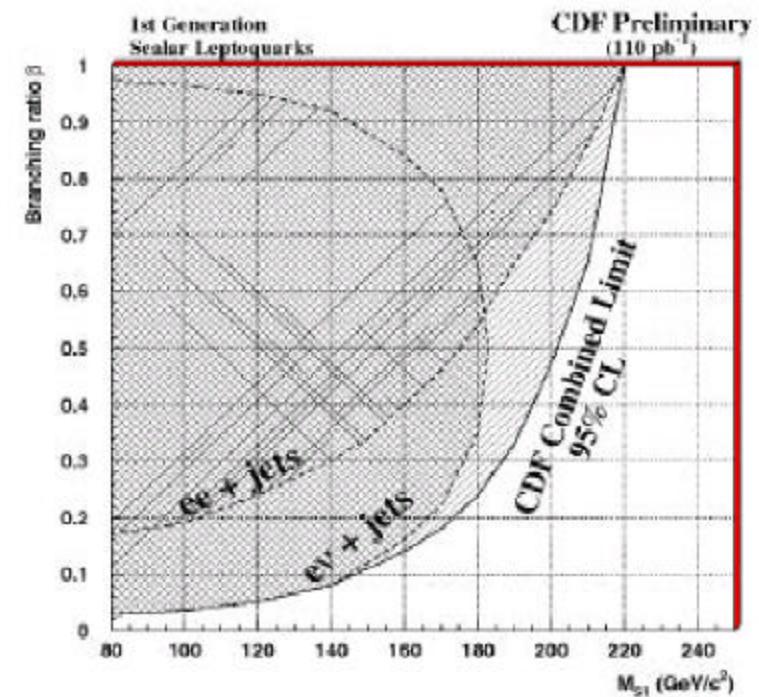


Tevatron Leptoquark Limits

- Limits depend on type of LQ (scalar/vector, generation), LQ-q-I couplings and $\beta = \text{BR}(\text{LQ} \rightarrow I^\pm q)$

1st generation LQ mass limits

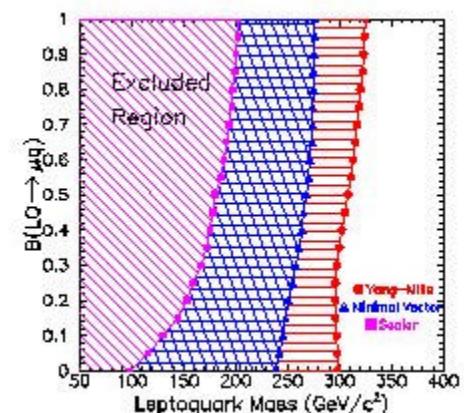
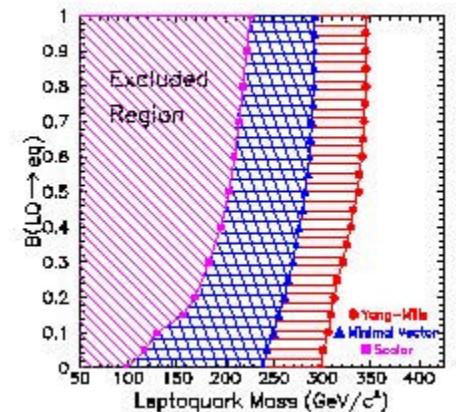
1 st Gen.	β	Scalar (GeV/c)	Vector Minimal Coupling (GeV/c)	Vector Yang-Mills Coupling (GeV/c)
DZero	1	225(242)	292	345
	0.5	204	282	337
	0	98	238	298
CDF	1	220(242)	280	330
	0.5	202	265	310



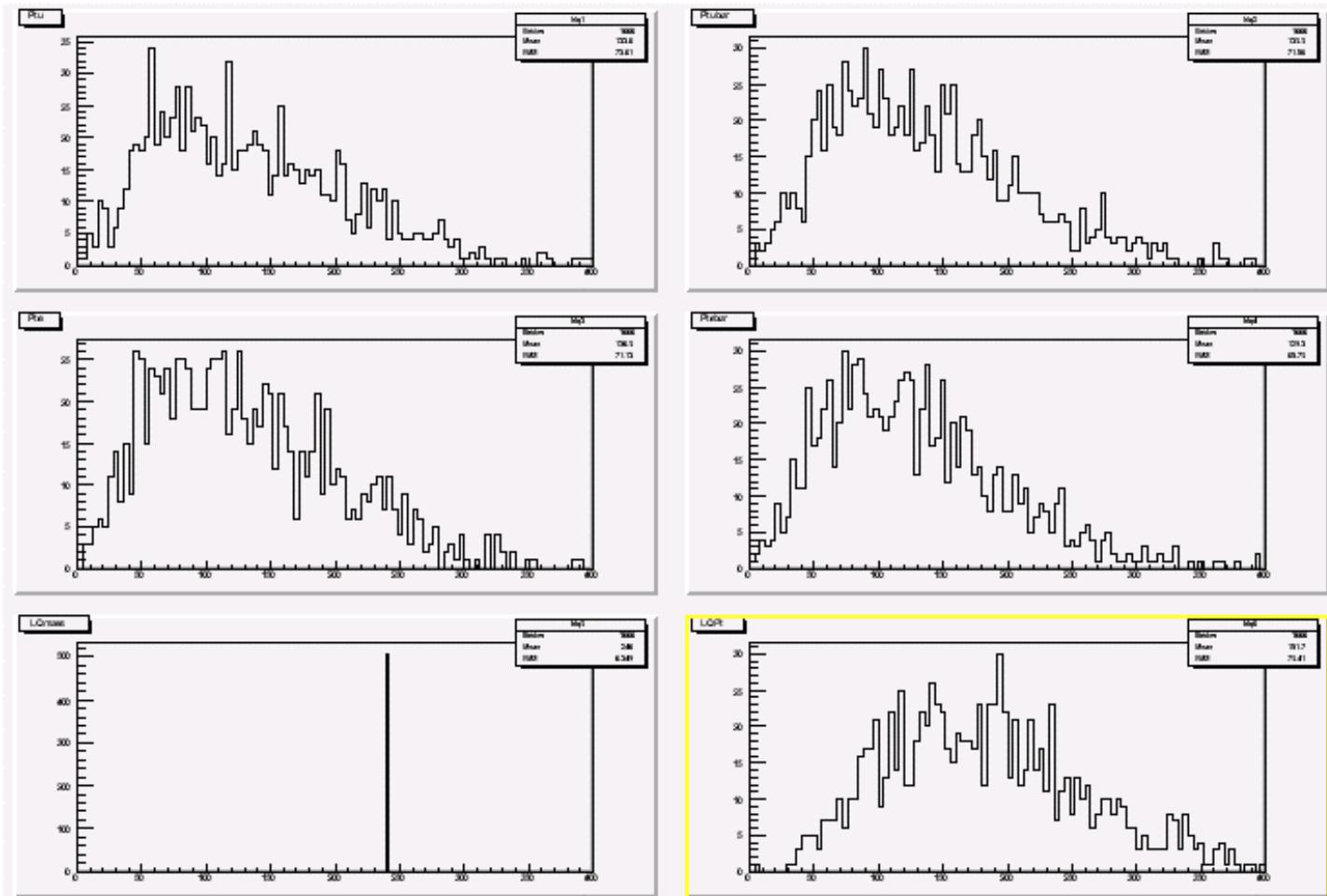
Tevatron Leptoquark Limits

2 nd Gen	β	Scalar (GeV/c)	Vector Minimal Coupling (GeV/c)	Vector Yang-Mills Coupling (GeV/c)
DZero	1	200	275	325
	0.5	180	260	310
	0	98	238	298
CDF	1	202		
	0	123	171	222

3 rd Gen	β	Scalar (GeV/c)	Vector Minimal Coupling (GeV/c)	Vector Yang-Mills Coupling (GeV/c)
DZero	0.5			209
	0	98	238	298
CDF	1	99	170	225
	0	148	199	250

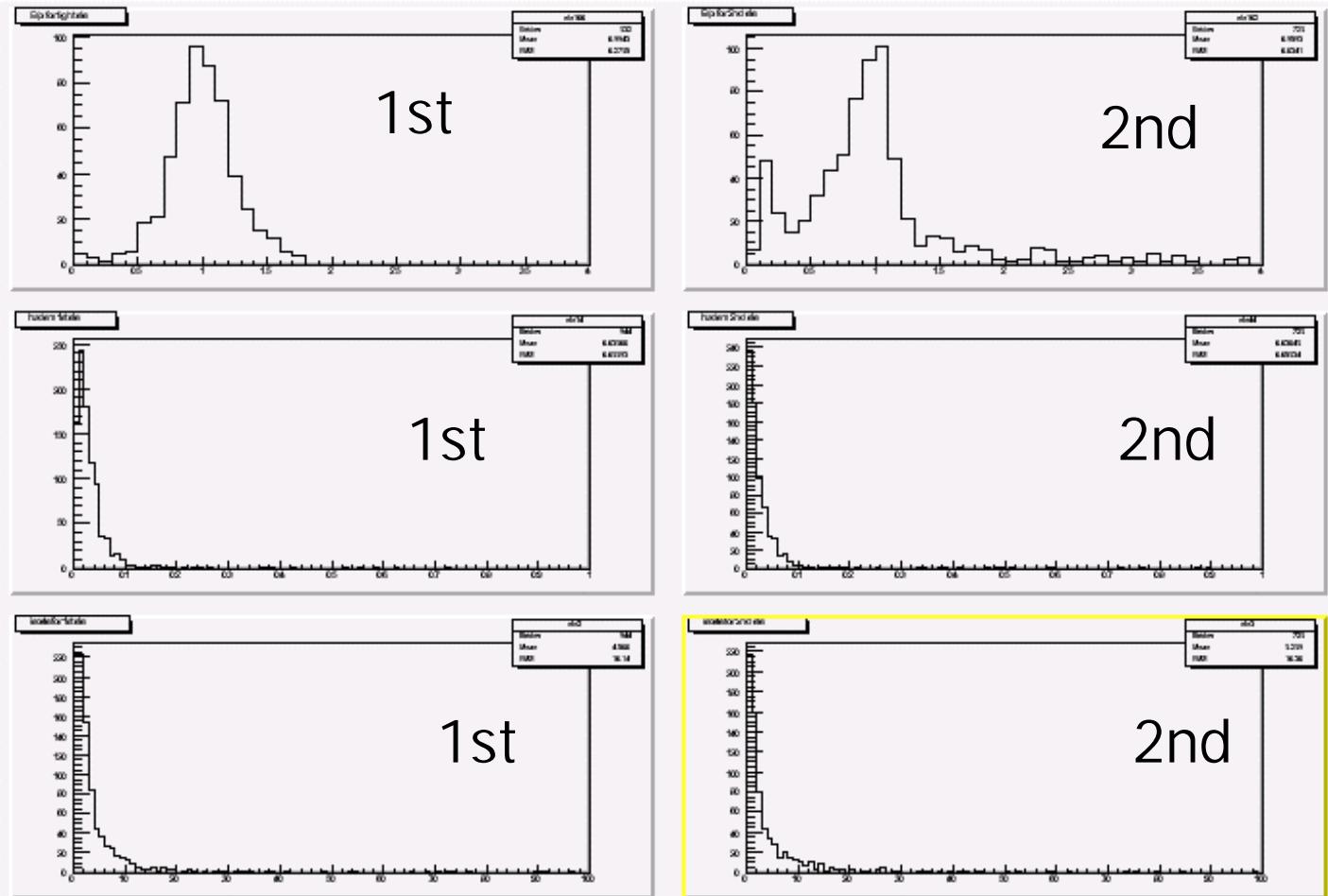


HEPG ($LQ_m = 240$)

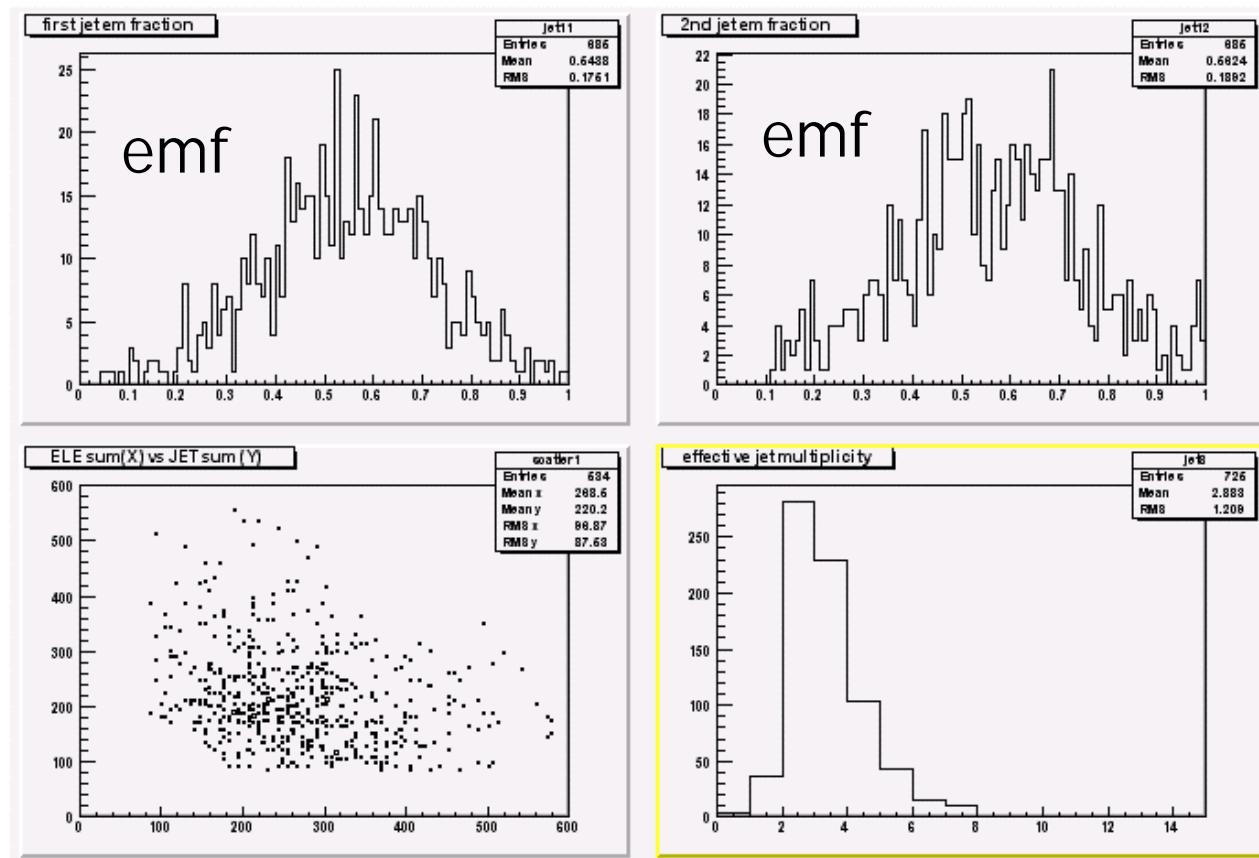


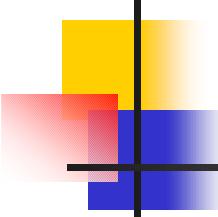
Electrons (LQ_m = 240)

E/p



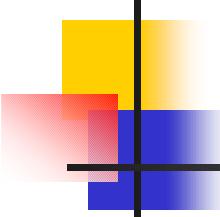
jets (LQ_m = 240)





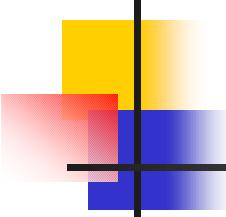
This analysis

- eejj channel
 - High pt electron dataset (Ele_18 && Ele_70)
 - 2 isolated electrons
 - One tight (central)
 - One loose (central or plug)
 - At least 2 energetic jets
 - Will follow the run I analysis
 - Not trying to change cuts now, except for ele ID



Tools

- Signal generated and reprocessed with 4.8.2
 - /home/rolli/physics/nov4
 - 1000 events at masses from 200 to 320
 - regenerating with 4.9.1
 - /cdf/scratch/simona/LQ/mc/signal - MRS-R2
 - /home/rolli/physics/nov26/mc/test - CTEQ5L
- eN (4.9.1)used for ntuple analysis
 - <http://ncdf70.fnal.gov:8001/talks/eN/eN.html>



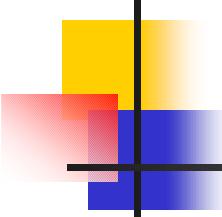
Data sample

```
module clone Prereq_HPTE
module enable Prereq-HPTE
module talk Prereq-HPTE
L1Accept    set true
L2Accept    set true
L3Accept    set false
L3TriggerNames set ELECTRON70_L2_JET      \
                 ELECTRON_CENTRAL_18      \
                 ELECTRON_CENTRAL_18_NO_L2 \
                 W_NOTRACK              \
                 W_NOTRACK_NO_L2         \
                 Z_NOTRACK
debug       set false
exit

module clone StripSingleE HPE1
module enable StripSingleE-HPE1
module talk StripSingleE-HPE1
elePtMin set 9.0
etCalMin set 18.0
delXMin set 3.0
delZMin set 5.0
EoPMax  set 4.0
IshrMax set 0.3
hademMax set 0.125
show
exit
```

- Inclusive high pt electrons from Top/EW-
- HighPtElectrons - Strip 4.8.4 - StripSingleE

```
module clone StripSingleE HPE2
module enable StripSingleE-HPE2
module talk StripSingleE-HPE2
elePtMin set 15.0
etCalMin set 70.0
delXMin set 3.0
delZMin set 5.0
show
exit
```



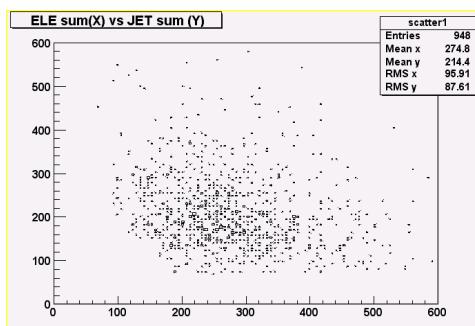
Efficiencies & acceptance

$$\epsilon_{\text{tot}} = \epsilon_{\text{Acc}}(M) \times \epsilon_{\text{ID}} \times \epsilon_{z0} \times \epsilon_{\text{trig}}$$

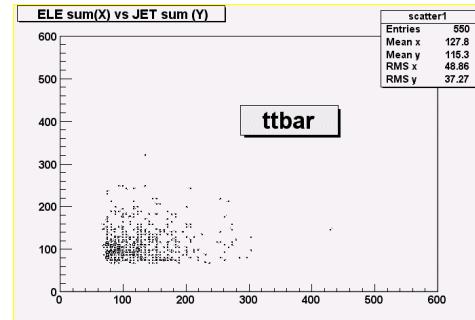
- Trigger
 - Top/EW - Z' analysis quotes $94.5 \pm 0.5\%$
- Efficiencies for electron selection cuts
 - cdf_6080 - Z' analysis - to be revised with new baseline cuts
- Other
 - efficiency on the vertex cut ($|z_0| < 60$ cm)
 $94.0 \pm 2.0\%$

Analysis cuts (run I)

- 2 ele with $E_T > 25$ GeV
- 2 jets with $E_T(j1) > 30$ and $E_T(j1) > 15$ GeV
- $76 < M_{ee} < 110$
- $E_T(j1) + E_T(j2) > 70$ &&
 $E_T(e1) + E_T(e2) > 70$
- $\sqrt{(E_T(j1) + E_T(j2))^2 + (E_T(e1) + E_T(e2))^2} > 200$



12/28/02



Simona Rolli Exotic meeting

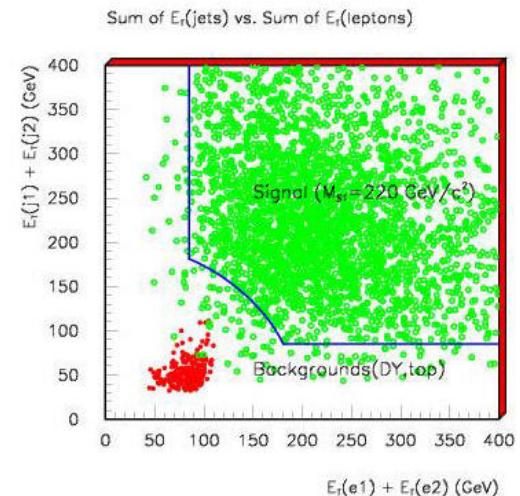
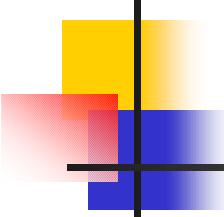


Figure 5.17: This plot shows the distribution of the sum of the corrected E_T 's of the two most energetic electrons versus the sum of the corrected E_T 's of the two most energetic jets for simulated signal (leptoquarks events with $M_{S1} = 220$ GeV/c 2) and for backgrounds (Drell-Yan and $t\bar{t}$ events). The blue right lines show the cuts at 85 GeV in the sums of the leptonic and jet energies, while the arch of circle shows the cut at 200 GeV on the variable $\sqrt{(E_T^C(e1) + E_T^C(e2))^2 + (E_T^C(jet1) + E_T^C(jet2))^2}$, which is the radius of a circle centered in $(0,0)$.



Electron ID

- Central electron (loose or tight)

- $E_t \geq 25 \text{ GeV}$ ()
- $p_t > 10 \text{ GeV}$
- $\text{hadem} \leq 0.055 + 0.00045 * E$
- $E/p < 4$ (for $Pt < 50 \text{ GeV}$)
- $\text{iso4e}/\text{emet} < 0.1$ (0.2 for second central loose)
- charge-signed DeltaX $-3.0 < Q_{\text{trk}} * \text{deltaX} < 1.5 \text{ cm}$
- $|\Delta Z| < 3.0 \text{ cm}$
- $I_{\text{sh}} <= 0.2$
- $|\chi^2_s| < 10$
- $|\text{vtx}_z - \text{el}_z| < 5$
- $|\text{el}_z| < 60$
- Conversion removal
- Fiducial = 1

$$\epsilon_{\text{CC}} = 88.1 \pm 2.0\%$$

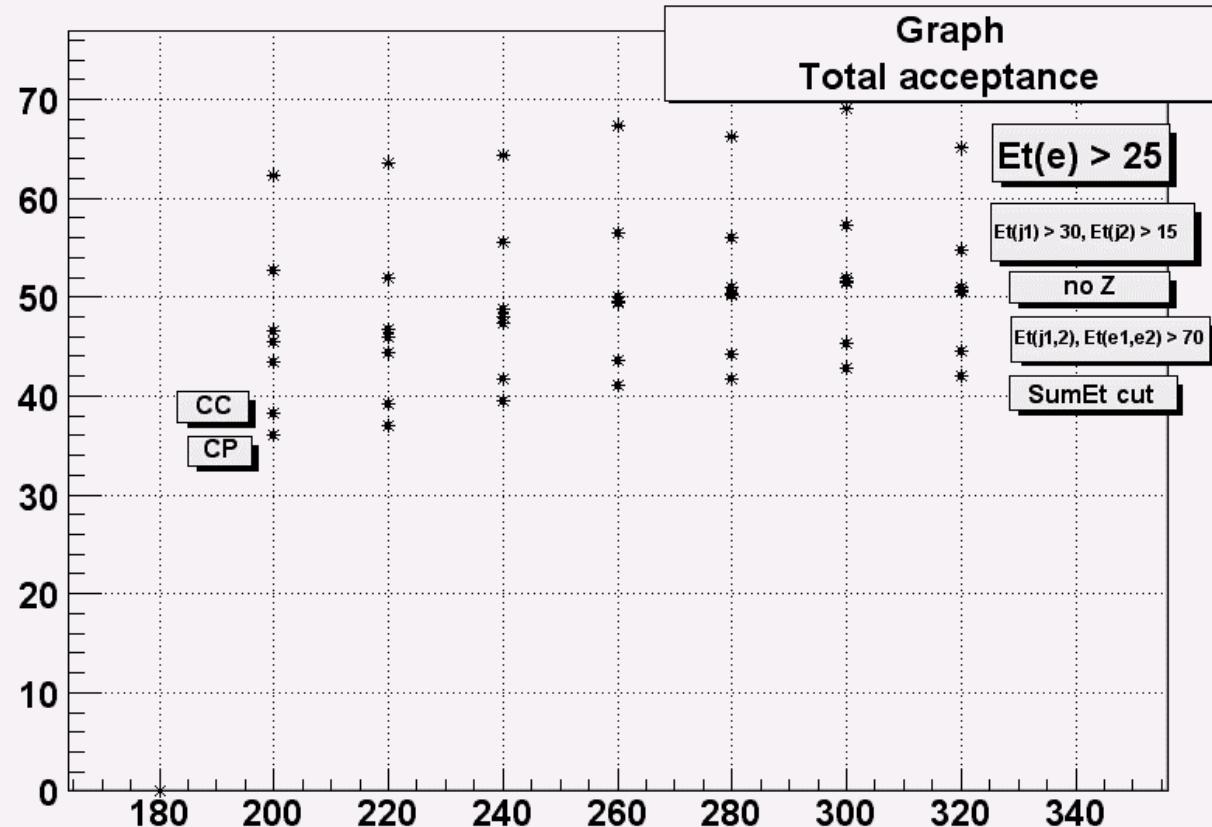
$$\epsilon_{\text{CP}} = 82.8 \pm 2.0\%$$

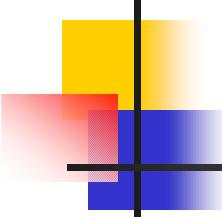
Cdf_6080

Second Loose ele plug

- Isolation < 0.1
- hadem $\leq 0.055 + 0.00045 * E$
- Fiducial $1 < |\eta| < 3$

Total acceptance



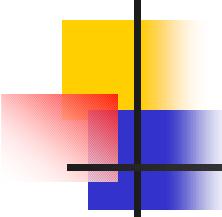


Background

Scaling from run I
assuming same
rejection efficiency

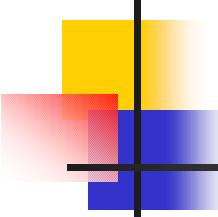
- tt with both $W \rightarrow e\nu$ $0.85 \pm -.20$
 - DY
 - DY + jet
 - DY + 2 jets
- }
- ~ 1

MC generation in progress



Plans

- Reprocess high et ele dataset with 4.9.1 + patches ?
 - Electron_central_18 & Electron_70
- Applying jet corrections
- Check newest electron id efficiency, trigger etc
- Background studies - most to be done, MC generation in progress - possible optimization of cuts
- systematic
- limit



Plans II

- Status
 - Jan 16 or Jan30
 - Preblessing Feb 6
 - Blessing Feb 20